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Commercial Fast Freight Ferry Designs and Their Application to Operational Logistics

By

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A paper submitted to the faculty of the Naval War College in partial satisfaction of the requirements of the Department of Joint Military Operations.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Naval War College or the Department of the Navy.

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The need for greater speed in operational logistics can be met by looking to recent developments in the commercial sector. Large, high-speed, combination freight and passenger ferries, known as Fast Freight Ferries (FFFs), are currently in commercial service. The employment of FFFs as rapid intra-theater and inter-theater sealift, in concert with the Maritime Prepositioning Force (MPF), would provide a greatly improved operational logistics speed and capacity.

FFF craft were developed as a result of market forces alone. Their design research and development costs have been borne by private industry. The cost savings to the military that could be realized by requisitioning these vessels directly from commercial trade are manifold. Independent development and military procurement of a purely military version of the same type platform would not be necessary. Militarily useful FFF designs could be requisitioned for government service directly from commercial trade on an as-needed basis.

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Without the ability to rapidly transport supporting personnel and materiel, the most thoroughly planned operation will almost certainly end in failure. As we enter the era of Network Centric Warfare (NCW), where Speed of Command[1] is often measured in seconds, theater operational logistics must keep pace with an increased demand for speed in the battlespace. This paper will seek to explore the changing operational logistics arena and offer solutions to challenges involving the need for increased speed of logistics as it relates to sealift.[2]

The need for greater speed in operational logistics can be met by looking to recent developments in the commercial sector. Large, high-speed, combination freight and passenger ferries, known as Fast Freight Ferries (FFFs), are currently in commercial service. The employment of FFFs as rapid intra-theater and inter-theater sealift, in concert with the Maritime Prepositioning Force (MPF), would provide a greatly improved operational logistics speed and capacity.

FFF craft were developed as a result of market forces alone. Their design research and development costs have been borne by private industry. The cost savings to the military that could be realized by requisitioning these vessels directly from commercial trade, as opposed to acquiring and maintaining a purely military FFF fleet, are manifold. Independent development and military procurement of a purely military version of the same type platform would not be necessary. Militarily useful FFF designs could be requisitioned for government service directly from commercial trade on an as-needed basis.

Introduction

Slave, I have set my life upon a cast,
And I will stand the hazard of the die:
I think there be six Richmonds in the field;
Five have I slain to-day instead of him.
A horse! A horse! My kingdom for a horse![3]

In William Shakespeare's play King Richard III, King Richard pressed the fight towards his enemy, Norfolk, despite a marked loss of essential (for that time) theater and tactical mobility. Having suffered the loss of his horse, he was thus reduced to the slow and vulnerable gait of the common foot soldier. Despite a valiant fight, King Richard succumbed to Norfolk. King Richard, without his mount, could not match the speed required of the battlespace. Had King Richard subsequently obtained a horse, he may have prevailed that day on Bosworth Field. At the very least, he might have lived to fight again another day by making good a retreat. This lack of required transport and an inability to maneuver in response to the enemy proved to be King Richard's undoing.

Mobility, specifically operational logistic mobility, remains no less a concern to the operational commander of today. Although today's Bosworth Field is far advanced from medieval warfare, effective transport remains a pivotal factor in any conflict. Future war fighting concepts such as Operational Maneuver From the Sea (OMFTS), Joint Mobile Offshore Base (JMOB) and Joint Vision 2010 involve increased length of supply lines and, as a result, require a more efficient (and faster) servicing of operational logistic needs. This need for greater speed in operational logistics can be met by looking to recent developments in the commercial sector.

The civilian demand for faster ferry service (both passenger and vehicle) has prompted the development of large FFF designs capable of carrying as many as 600

passengers and 240 cars.[4] Current designs of FFFs are capable of operating in excess of 40 knots.[5] This is precisely the speed and capacity of lift required to provide enhanced support for theater operations today. This is also the minimum level of required support to enable the successful operational maturity of our future warfighting concepts. Although the commercial FFF design offers great inherent military utility in supporting these concepts, there are several problems engendered by requisitioning FFFs directly from active commercial trade.

Problems Associated With Direct Requisition of the FFF From Civilian Trade

There are problems inherent with depending upon industry to maintain and then provide a military asset in time of crisis. Disruption to established commercial service can economically damage a commercial operator or halt civilian commerce. From an engineering standpoint,. civilian designs may prove to lack the robustness required for successful, sustained military operations. Civilian crews of FFFs may lack the training necessary to operate within a military setting.

Overcoming these problems would require the cooperative efforts of the naval community and the maritime industry. One solution would be to enact maritime legislation providing an operating cost subsidy to commercial operators of large, militarily useful FFF fleets. A subsidy of this type, sufficient to encourage the maintenance of an artificially large FFF fleet, would mitigate the economic impact to a company resulting from the loss of an FFF to temporary war service. Encouraging the construction of militarily useful FFF designs in sufficient numbers would also ensure vessel availability to the military in time of crisis.

Manning and training issues may be addressed by utilizing the existing Merchant Marine Reserve (MMR) program and its pool of maritime academy graduates, particularly recent graduates, as a ready reserve of personnel trained in FFF maritime skills and familiar

with military operations. The ever-shrinking American Merchant Marine provides scant shipboard employment for many of these recent graduates. Recruiting these individuals into special MMR units dedicated to FFF training and the maintenance of the currency of maritime skills would rapidly create a ready pool of FFF talent for contingency FFF mobilizations. Selected Reservists (SELRES) in these FFF MMR units could drill aboard subsidized FFFs to gain experience. The expense of SELRES FFF proficiency training could be reduced by employing existing commercial computer bridge simulators configured with FFF-specific software. The creation of a new reserve program with a unique MMR FFF warfare designator could ensure the maintenance of a large pool of qualified naval officers for future sealift contingencies. Financial incentives to affiliate with such reserve units could include allowing SELRES personnel multiple additional drill periods for proficiency training (involving actual FFF experience with commercial operators) such as is practiced in reserve aviation units. A form of "flight pay" could be offered as well to encourage affiliation and retention in such special units. The costs generated by such a reserve unit would be limited to pay and temporary additional duty for a small cadre of officers and enlisted personnel. Most overhead costs would already be borne by the FFF operator as a matter of course.

The battlespace of the future will suffer from increased time compression as technology progresses. Decisions will be made more quickly. Operational logistics will have to keep pace. The operational commander must move away from a specious and expensive logic that envisions a new and unique platform for each emergent mission. By utilizing an existing commercial asset, the tempo of present and future operational logistics can move ahead with today's technology without pausing for an often ponderous military procurement process.

Current Fast Freight Ferry Designs

Several militarily useful FFF designs have been recently developed outside the United States. Incat Australia has developed and delivered into commercial service a 91-meter, 400-deadweight ton (dwt) ferry with a capacity of 260 vehicles (roll on/roll off or Ro-Ro) and 900 passengers. The fast ferry *Catalonia* is a catamaran-hulled, wave-piercing design powered by four Caterpillar 3618 diesels which drive a waterjet propulsion system. *Catalonia* has a beam of 26 meters and draws 3.7 meters of water. *Catalonia's* speed in a lightship condition is 48 knots. With a full 450 dwt load she can reach 43 knots.[6] *Catalonia's* relatively shallow draft, high speed and inherently stable catamaran design offer a potent capability for operation in the littorals.

Catalonia's performance during her delivery voyage in June of 1998 illustrates her potential in an operational logistics role. *Catalonia* crossed from Manhattan to Tarifa, Spain, in 3 days, 9 hours and 55 minutes. Average speed for this journey was 38.877 knots. This was a distance of 3,125 miles. This demonstrated speed sustained over a considerable range illustrates a potential for rapid self-deployment of FFF platforms into distant theaters.[7]

Despite an impressive self-deployment capability, FFFs are primarily built for operation on relatively short commercial routes as opposed to making routine, open ocean passages. A self-lift of several thousand miles would require an adjustment in cargo loading in favor of added fuel as opposed to embarking a full complement of troops and military rolling stock. Once in theater, the FFF transport advantages of high speed and high capacity (troops and supporting materiel embarked) over more moderate ranges could be exploited.

In 1999, Incat Australia subsequently delivered an improved variant of the *Catalonia* called *Devil Cat. Devil Cat* retained a similar catamaran design and length (96 meters) with a

slight increase in draft; but the deadweight capacity was increased to 800 tons. The vessel features a stern with dual loading ramps for Ro-Ro operation. *Devil Cat* can be configured to carry 85 cars and up to 24 road-freight trailers. 600 passengers can be carried in the upper accommodation spaces. *Devil Cat's* redesigned hull form is capable of 49.3 knots with a 55-dwt loading.[8] The high speed of the fast freight ferry and wide combinations of passengers, rolling stock and logistics materiel that can be carried by a vessel of this design allow the operational commander great flexibility in theater deployment and movement.

The *Devil Cat* design resulted in a 60% increase in deadweight capacity over *Catalonia* in approximately a year's development time.[9] Rapid commercial development of this kind could obviate the need for the military to fund separate research and development into FFF design. Passenger carriage, be it civilian or military, differs little whether the passengers are soldiers carrying rifles or commuters with briefcases. The generous lane dimensions now accommodating road freight sized vehicles aboard a vessel such as *Devil Cat* could allow for carriage of much current military rolling stock.

FFF construction is not limited to the catamaran design alone. Italy's Fincantieri Navali SpA has constructed a 100 meter deep-vee monohull called *Superseacat One*. This vessel carries 800 passengers and 175 cars. It is capable of 38 knots. It is also fitted with a ride control system and roll damping fins.[10] Lockheed Martin has produced a prototype vessel for the U.S. Navy called SLICE. It incorporates a wide (55 feet) superstructure with struts mounted to torpedo-shaped submerged pontoons. Configured similar to a catamaran, this small (105 feet) and stable vessel has a top speed of 31.6 knots.[11]

FFF designs vary according to the desired stability, sea keeping performance and employment envisioned by their civilian operators. Large catamaran designs offer the

obvious advantages of large capacity, shallow draft and stability required of future littoral operations. But the catamaran is not the only viable design. The military acquisition community essentially could window shop for an FFF platform that meets its needs without the financial outlay and risk inherent in purely military, ground-up development

Jones Act restrictions prevent a foreign company from building vessels for the U.S. coastal trade (the area targeted by the majority of FFF operators). Should the FFF be adapted to a U.S. military role, domestic construction of these designs would be both advantageous and desirable. Through licensing agreements, FFFs of foreign design are being built in U.S. shipyards. While FFF designs have largely originated outside the United States, continued construction of these designs in U.S. shipyards would ensure a requisite domestic defense production capability for the future.

Operational Maneuver From the Sea (OMFTS)

Mobility is a key element in the support of the OMFTS concept. "The OMFTS force...will have to sortie from widely separated seabases...as it moves towards objectives deep inside the battlespace."[12] Speed and the ability to move not just personnel, but accompanying equipment, are paramount in generating and sustaining sufficient combat power. The use of the FFF would allow faster transits with a greater depth and breadth of equipment support than is now currently available.[13] Rapid movement within a theater between seabases (or between theaters) of large concentrations of personnel could become a reality with the employment of the FFF. Personnel could also be accompanied by large blocks of their own supporting rolling stock and materiel.

The Ro-Ro capability of a large, fast freight ferry allows for rapid offload at a prepared host nation port facility. FFF Ro-Ro ramp designs vary widely (as do port facilities

themselves) and do not conform to a singular port facility standard. Slight modification of host nation wharf facilities may be necessary to effectively service the Ro-Ro capability of an offloading FFF. An interface with Joint Logistics Over The Shore (JLOTS) equipment to accommodate FFF offload would have to be developed to allow envisioned beach lodgement debarkation from an FFF. Funding already in place for merchant ship National Defense Features could be applied to facilitate the modification of domestic FFF construction to include a JLOTS-compatible ramp system.

The concept of interchangeability so vital to the application of OMFTS, can be realized by the advent of the greater operational mobility offered by the use of a vessel such as the FFF. If forces and resources have to flex and adapt to complement one another's ability to generate combat power, the fast freight ferry offers precisely that capability.[14] Additionally, logistics capabilities must support "...operations ranging from humanitarian assistance to high-intensity conflict."[15] By utilizing an FFF, the rapid evacuation of personnel during Non-combatant Evacuation Operations (NEO) could be effected with the same platform utilized for the delivery of reinforcements and supplies to the beachhead of the future. Reconfiguration of the platform between missions would not be required. Evacuation of large blocks of civilian or military personnel to offshore sanctuaries could be rapidly accomplished. The long range and high capacity of the FFF would allow for rapid transport of large numbers of civilians to distant safety even *outside* the theater. Conversely, the FFF could take the fight to the enemy with equal speed.

OMFTS' successful application is predicated on the existence of an adequate level of available amphibious shipping. In order to project power from the sea and across the beach, this lift capability must be sufficient to increase operational tempo and support the Marine

air-ground forces. OMFTS amphibious assault is founded upon operation from a distant seabase in order to reduce the threat. The LCAC and the Advanced Amphibious Assault Vehicle (AAAV) platforms currently provide the surface link over-the-horizon (OTH) to the beachhead.[16] Adapting the FFF concept to the OMFTS requirement for sea basing would introduce a great measure of mission flexibility. This platform could act variously in missions such as inter-theater rapid transit, mass casualty evacuation and, with a JLOTS interface, rapid beachhead combat support.

The Maritime Prepositioning Force (MPF) and the Future

The current MPF force is highly dependent on the use of port facilities for in-theater offload. An overseas port can quickly be made unusable by chemical, biological or nuclear contamination. An overseas port can be denied to MPF use solely for diplomatic reasons. Although MPF ships can presently offload up to four miles offshore, they still remain well within range of small boats with shoulder-launched missiles and shore-based threats. The OMFTS strategy of the future posits the placement of MPF assets behind the amphibious task force up to 25 miles offshore to reduce such vulnerability[17].

When OMFTS is fully implemented, the MPF role will shift to that of sea basing. As now postulated, MPF would no longer require a benign port for offload. The ability to operate independently from a seabase is predicated upon future MPF ships having enhanced aviation and self-offload capabilities. In the future, the congestion and vulnerability of conventional ports and airfields will be avoided by flying the Marines directly to the MPF ships. Marines flown in from the continental United States (CONUS) will marry up with their equipment aboard MPF ships and subsequently launch their OTH offensive from the ship itself. Complementing the capabilities of the V-22, the FFF could be used as a fast

troopship to effect linkup with MPF ships in theater. The range and speed of the FFF are sufficient to provide transport from sanctuary areas well clear of theater threats.[18]

Providing support from a distant, but protected, seabase reduces the traditional Marine beach footprint support problem but introduces a new difficulty. Logistics distribution tasks previously performed ashore will now have to be performed at a seabase or in CONUS. Logistics requirements will have to be met with prepackaged, presorted containerized cargo. The containerization can be accomplished in CONUS, but the selective breakout of these packages for delivery ashore will have to be performed in-theater aboard the MPF platforms.[19]

"Our just-in-case system (of logistics delivery) has evolved over the years in response to…a lack of a fast and responsive transportation system. This system is in stark contrast to the just-in-time material management systems being implemented by commercial enterprises and our own industrial partners."[20] Political, military and regional sensitivities will continue to frustrate U.S. dependence on foreign land bases. Likewise, in a hostile environment, the build up of a substantial beachhead carries with it the requirement to maintain and protect it. The speed advantage and intermodal capability of the FFF to deliver containerized, tailored combat support packages ashore would allow the beach footprint to shrink and become less of a restriction to maneuver[21]

The challenge of how to rapidly close the envisioned 25-mile gap between the MPF platform of the future and the beachhead with current amphibious shipping assets remains. Current lighterage speed is four to six knots. A faster surface platform is required. The adaptation of the FFF to a lighterage role could reduce transit time to the beachhead and increase sortie generation rates. Acting in a lighterage role, the FFF could transport

significantly larger loads at a higher speed than the current LCAC platform. MPF requirements call for a lighterage capability in up to sea state three. The FFF catamaran design is highly stable and lends itself well to such a role. The role of fast lighter would require some modification of the FFF Ro-Ro ramp design. Modification of current MPF Ro-Ro ramps to allow at-sea disbursement or receipt of containerized combat support loads would enable the FFF to take on this crucial role.

Sustaining The Joint Mobile Offshore Base (JMOB)

The future JMOB concept would provide a mobile and sustainable overseas presence as an alternative to land-based options within host nations. In an uncertain world where unrestricted access to ports and logistic facilities is no longer a guarantee, an independent sea base offers sanctuary and forward presence. A JMOB, as now envisioned, featuring a 5000-foot runway[22] and repair facilities for aviation and surface units would offer great flexibility to an operational commander. The JMOB would enable precisely the type of seabased support required to fully implement OMFTS. But, how will such a large forward presence be sustained?

Airlift is often an expensive luxury in the operational logistics world. Though attractive, it is not feasible to embark all logistics materiel by air. The vast majority of materiel has to move by ship. If the JMOB concept is to provide sustainability to forward-deployed units, a fast, efficient link to the JMOB besides airlift will have to be employed in order to sustain the JMOB itself.

The FFF concept could provide a rapid replenishment capability to the JMOB. One key capability of the JMOB is the stability and shelter it could provide for resupply and reloading of critical items such as seabased Tomahawk Land Attack Missiles (TLAMs). The

TLAM has become a favored method of military response during recent crises and doubtless will continue to be employed as such.[23] The FFF could act as the fast link to the JMOB to maintain this critical inventory, among others, in theater. Future development of modular, containerized servicing equipment for Tomahawk reload at sea could allow the FFF to be alternately employed as a Tomahawk fast replenishment platform.

Sealift Support From Outside the Ready Reserve Force (RRF)

The RRF totaled 96 ships in August of 1990. Seventy-nine of these ships were activated in support of Desert Shield and Desert Storm. This no-notice activation of these assets pointed out a major shortcoming in force readiness. Activation times were almost always longer than advertised. Of the 62 dry cargo ships activated, only 20 vessels were activated within their specified time periods of five, 10 or 20 days.[24] Analysis after the conflict showed a decided lack of funding had prevented RRF ships from performing sufficient test activations for some years prior to Desert Shield/Storm.[25] After Desert Storm, the funding and readiness posture of RRF ships was increased. But it will never be possible, or practical, to keep all RRF ships in a no-notice status all the time

The FFF operational logistics concept relies on vessels in current commercial trade which are already in a known operating status. Shipyard assistance is not required in requisitioning an FFF for service as is with a majority of RRF vessels. Regular maintenance status reports to the Navy provided by an FFF operator would provide logistics planners the service status of militarily useful FFF platforms as they operate in their commercial employment. The material condition and operating potential of FFF fleets could be known well prior to actual requisition for military service. Delays incurred with the requisition of an

FFF would likely accrue only in transit time to the theater as opposed to that involved in awaiting reactivation from a dormant storage condition.

The MPF, by definition, requires direct military involvement in ship procurement, vessel charter and the concomitant maintenance of embarked, prepositioned equipment itself. An FFF vessel earmarked as a high-speed link between MPF assets and a distant port facility or beachhead would not require a prepositioned posture. Such an FFF could be requisitioned *when needed* and moved into theater as an operation matures. Similarly, the use of an FFF as an inter-theater or intra-theater transport would not require prepositioning. Desired FFF platforms currently in operational service could be removed from commercial use and deployed in a lightship condition to minimize transit time to the required theater location.

Maritime Policy and the Support of the FFF Concept

Current maritime industry programs could be adapted to support and encourage commercial FFF operation. The Maritime Security Program (MSP) provides incentives for American commercial carriers to retain ships under the American flag and crew them with American citizens. Ships under this program are operated in such a manner that sponsored companies agree to be available should a need for them arise. Currently, 47 ships participate in what is known as the Voluntary Intermodal Sealift Agreement (VISA) program. Besides ensuring an adequate degree of guaranteed sealift in times of crisis, the VISA program helps maintain an American merchant marine fleet. To be included in this program, the owner/operator of the vessel must be a U.S. citizen and the vessel must be "militarily useful"[26]. The VISA program could be expanded to include support for the commercial operators currently operating those FFFs of interest to the military. The combination of market forces and government financial incentive could ensure a healthy posture for this

growing maritime industry sector and provide a cost-effective sealift capability at the same time.

FFF Operating Risks

The introduction of the FFF into operating proximity of naval combatants would require operational adjustments on the part of the operator and accompanying combatants. The greatly increased transit speeds of the FFF contribute to a higher risk of possible collision. Vessel Traffic Control (VTC), where ships' progress through congested waters is monitored through radar and position reports, would have to be effected within the battlespace to deconflict FFFs from slower vessels. Additional training and Standard Operating Procedures (SOP) would have to be developed to familiarize conventional bridge watch teams with the higher speeds and increased risk of collision inherent in operating in concert with FFFs. A secure standard of navigation markings would have to be developed to allow bridge navigation teams aboard conventional vessels to visually identify the presence of an FFF in their area.[27]

Some FFFs produce a unique phenomenon known as a soliton when operating at high speeds. A soliton is a solitary wave that is formed by the bow of an FFF operating at speed. The wave consists of a peak without a balancing trough behind it. It amounts to a moving mass of water several centimeters above the general water level. The soliton is difficult to detect and only manifests itself as it encounters shallow water. With no trough to fall back into, the soliton behaves in a fashion similar to a tsunami. It is difficult to detect in the open ocean; and it becomes very powerful when it encounters shallow water or the shore.[28] This tendency to produce a large and destructive wave in shallow littoral operating

areas requires both operator situational awareness and circumspection on the part of fellow combatant forces.

Washington State Ferries has taken delivery of an Australian design (U.S. built) passenger ferry called *Chinook*. *Chinook's* design incorporates reduced wake and wash output levels, an environmental and operating safety improvement. Destructive wake effects have been identified as a hazard generated by some high-speed ferry designs.[29] Chinook's reduced wake improvements are an example of the commercial shipbuilding industry solving a design problem of benefit to the military without any defense dollar outlay.

Current maritime commerce is conducted at significantly lower speeds than that encountered in FFF operation. Navigation and collision avoidance decisions aboard an FFF must be made with a greater degree of accuracy and celerity than previously practiced by conventional bridge watch personnel. To operate safely and effectively in this accelerated environment, the training regimens for operators of FFF's will likely need to embrace aviation concepts such as situational awareness, cockpit (bridge) resource management and operational risk management (ORM). We may see this type of training as part of the Coast Guard License Curriculum at the U.S. Merchant Marine Academy and state maritime academies. This early exposure to FFF operations would develop a necessary awareness of FFF operating characteristics amongst the cadre of future maritime watch officers. This training could also serve as a recruiting tool for selecting future candidates for envisioned FFF MMR units.

Joint Vision 2010

"We must maintain a careful balance between equipping and sustaining our forces and between tooth and tail in our force structure."[30] The notion of equipping a force often

conjures visions of new platforms (platforms developed and purchased with defense dollars) and new missions attached to those platforms. The FFF concept exploits an existing commercial asset, developed independently from dedicated defense funding, for a military purpose. The acquisition time saved by adopting a currently operating, commercially-developed platform to an operational logistics role is one method that can reduce the tail of our force structure.

Joint Vision 2010 makes mention of "The Imperative of Jointness". "Simply to retain our effectiveness with less redundancy, we will need to wring every ounce of capability from every available source."[31] More than simply assuring the integration of military agencies is involved here. The capabilities mentioned in Joint Vision 2010 must include the incorporation of private industry product and practice. The acquisition process must include expanded mechanisms to acquire sealift platforms, of any size, or services through charter and hire as opposed to outright purchase. As previously mentioned, a maritime policy favorable to the expanded development and operation of FFF service can provide a handsome defense dividend. The end result can be a robust civilian industry supporting an equally robust operational logistics capability.

Focused Logistics is a cornerstone of Joint Vision 2010. "Modular and specifically tailored support packages will evolve in response to wide-ranging contingency requirements. Service and Defense agencies will work jointly and integrate with the civilian sector, where required, to take advantage of advanced business practices, commercial economies, and global networks. "[32] OMFTS requires tailored, containerized support packages to decrease beach footprint. It is here that OMFTS echoes the logistics design of Joint Vision 2010. The FFF is currently delivering commercial cargo in the form of containerized truck cargo.

Current business emphasis in the transportation industry on modularity (containerized cargo) and intermodalism (the capability to move seamlessly from one transport platform to the next) could provide the military with a solution to the support package challenge.

Conclusion

The future warfighting concepts discussed herein will require speed and flexibility in their combat support needs. Projecting and sustaining combat power from a sea position over the horizon requires speed and high capacity. The traditional solution of developing a specialized platform to address a perceived lack of military capability is no longer practical in light of the recent trend towards defense budget austerity. By embracing an emergent industry and its technology, the military can quickly and effectively acquire the platform needed to advance the missions of the future at a fraction of the cost. By working in unison, the maritime industry and the military could ensure that domestic maritime trade could produce a robust military sealift capability.

Endnotes

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[3] Shakespeare, William Richard III, Act 5, Scene 4.

[4] "New Devil Cat Has More Muscle." Marine Log, February 1999, 55-56.

[5] Ibid, 56.

[6] "Upping the Knots and Reining in the Risks." Marine Log, July 1998, 15-18.

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[8] "New Devil Cat Has More Muscle.", 56.

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[10] "Distinctive Passenger Vessels." Marine Log, January 1998, 25.

[11] Ibid, 23.

[12] Krulak, Charles C. "Operational Maneuver From the Sea." U.S. Naval Institute Proceedings, January 1997, 29.

[13] In comparison to the speed and load capabilities of the Landing Craft Air Cushion (LCAC) currently employed by the US Marine Corps, the high-speed ferry can effect greater logistics output with each sortie despite the LCAC's ability to approach the same speed.

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